SHUL'MAN, A., kandidat ekonomicheskikh nauk

Implement the further growth of centralized transport in the R.S.F.S.R.
Avt.transp.33 no.8:12-14 Ag'55.   (MLRA 8:12)
                         (Transportation, Automotive)

SHUL'MAN, A., kandidat ekonomicheskikh nauk.

Some problems in developing production in automotive repair work.
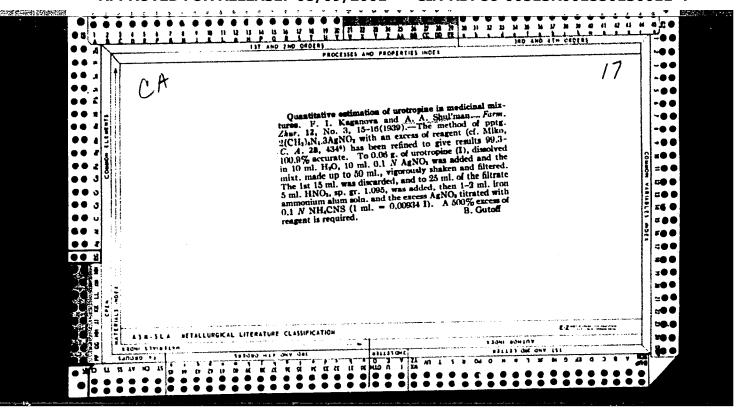Avt.transp.32 no.2:8-10 F '56.   (MLRA 9:7)
(Automobiles--Repairing)

SHUL'MAN, A., kand. tekhn. nauk

Pay greater attention to the economic aspects of the plan.
Avt. transp. 37 no.10:40-44 O '59.   (MIRA 13:2)
              (Transportation, Automotive)

SHUL'MAN, A.

           Increase the labor productivity. Avt.transp. 40 no.5:35-37
           My '62.
                                                    (MIRA 15:5)
                   (Transportation, Automotive--Labor productivity)

1ST AND 2ND ORDERS

PROCESSES AND PROPERTIES INDEX

CA

17

Quantitative estimation of urotropine in medicinal mixtures. F. I. Kaganova and A. A. Shul'man.— *Farm. Zhur.* 12, No. 3, 15–16(1939).—The method of pptg. $2(CH_2)_6N_4.3AgNO_3$ with an excess of reagent (cf. Miko, C. A. 28, 434⁴) has been refined to give results 99.3–100.9% accurate. To 0.06 g. of urotropine (I), dissolved in 10 ml. H_2O, 10 ml. 0.1 N $AgNO_3$ was added and the mixt. made up to 50 ml., vigorously shaken and filtered. The 1st 15 ml. was discarded, and to 25 ml. of the filtrate 5 ml. HNO_3, sp. gr. 1.095, was added, then 1–2 ml. iron ammonium alum soln. and the excess $AgNO_3$ titrated with 0.1 N NH_4CNS (1 ml. = 0.00934 I). A 500% excess of reagent is required.   B. Gutoff

ASM-SLA   METALLURGICAL LITERATURE CLASSIFICATION

SHUL'MAN, A. A.

T 2)   Shul'man, A. A.   O Pogloyvanii I Oformlenii Vrachebnykh Retseptov.
        Trudy ab. Dela, 1948. No. 6, STR. 521-32

        IN: Iatogic' Zhurnal Statey, No. 30, Moscow, 1948

BASHTAN, F.A.; GOLOBIN, D.I.; STAPANOVA; SHUL'MAN, A.A.

Prevention of Basedow's disease caused by iodine. Vrach.delo
no.2:201 F '57.   (MLRA 10:6)

1. Chernovitskiy meditsinskiy institut.
        (POTASSIUM IODIDE--TOXICOLOGY)
        (GRAVES' DISEASES)

SHUL'MAN, A.A. (Chernovitsy USSR)

Preparation of Nessler reagent. Apt.delo 6 no.6:53 N-D '57. (MIRA 10:12)
(CHEMICAL TESTS AND REAGENTS)

SHUL'MAN, A.A.; ZAKRIVIDOROGA, Z.S.

Oil from linden seeds. Vrach.delo no.1:93 Ja '58.   (MIRA 11:3)

1. Kafedra farmakologii (zav.-prof. S.P.Zakrividoroga) Chernovitskogo
meditsinskogo instituta.
        (LINDEN OIL)

SHUL'MAN, A.B.

Inelastic scattering of electrons in nickel and molybdenum targets. A. B. Shul'man and I. I. Farbshtein (M. I. Kalinin Polytech. Inst., Leningrad). *Doklady Akad. Nauk S.S.S.R.* 104, 56-9(1955).—Carefully cleaned targets of Ni and Mo were irradiated with slow electrons and the scattering was analyzed by means of a spherical condenser. A series of 18 measurements was made for Ni and the position of the max. corresponded to an av. loss of 12.5 ± 0.5 v. For Mo a series of 9 measurements showed 3 max. at 5.5, 11.6, and 17 ± 0.8 v. The exptl. data indicate that, for metals, the inelastic scattering is detd. by the intrazonal transitions of the lattice electrons.

J. Roviar Leach

AUTHOR: Shul'man, A. B.   SOV/57-58-8-16/37

TITLE: Work Function of Thin Films of Thorium Oxide and of Thorium
              on Tungsten (Rabota vykhoda tonkikh plenok okisi toriya i
              toriya na vol'frame)

PERIODICAL: Zhurnal tekhnicheskoy fiziki, 1958, Nr 8,
              pp 1711 - 1713 (USSR)

ABSTRACT: This is a study of the behaviour of thin thorium oxide
              films on tungsten, which is of importance in practical work.
              The experiments were carried out according to the method
              described in reference 1 and with the same equipment. The
              application of the film, the activation of the films and
              the measurement of their thickness was carried out similarly
              as in reference 1. The measurements were made by the student-
              diplomantka (preparing for her diploma)V.P.Klychkova. New,
              not activated, oxidized and activated films were examined.
              The activation temperature of the various cathodes was within
              the range of 1300 - 1650°K. The activation period usually
              was about 1 hour. A stable emission was obtained after 30-40
Card 1/3   minutes. The measured values of the work function of tungsten

Work Function of Thin Films of Thorium Oxide and   SOV/57-58-8-16/37
of Thorium on Tungsten

filaments well agree with data presented in publications.
The process of cathode activation and hence also the activation
curves are similar to those of films on a molybdenum basis.
However, the desoxidation of thorium oxide on tungsten proceeds
less easily than that on a molybdenum basis. The principal
results are interpreted in a similar manner as were those
in reference 1. The mean results of these and of earlier
measurements are compared. It is shown that in a steady state
the general course taken by the functions $\varphi=\varphi(\Theta)$ and $A = A(\Theta)$
almost coincides for films on tungsten and on molybdenum.
When films on tungsten are exposed to air for a certain time,
a comparatively high work function was observed in a few
cases (at small Θ) up to 6 eV. This was not observed on a
molybdenum basis. The information obtained indicates that
thin films of thorium oxide on tungsten are completely
desoxidized to metallic thorium, whereas in thicker layers the
oxide is only partially reduced. There are 2 figures, 1 table,
and 1 reference, 1 of which is Soviet.

Card 2/3

Work Function of Thin Films of Thorium Oxide and   SOV/57-58-8-16/37
of Thorium on Tungsten

ASSOCIATION: Leningradskiy politekhnicheskiy institut im.M.I.Kalinina
             (Leningrad Polytechnical Institute imeni M.I.Kalinin)

SUBMITTED: September 18, 1957

Card 3/3

CHISTYAKOV, A.N., GONOR, A.A., SHUL'MAN, A.I.

Some data on the chemical composition of pitch distillates.
Trudy LTI no.58:71-74 '59.   (MIRA 13:7)

1. Leningradskiy tekhnologicheskiy institut im. Lensoveta.
(Coal-tar products)

SHUL'MAN, A.M.

Neglected field of work. Apt.delo 3 no.1:30-31 Ja-F '54.

(MLRA 7:1)

1. Zaveduyushchiy otdelom aptechnoy seti Chernovitskogo oblastno-
go aptechnogo upravleniya. (Mgr., Div. of Pharmacies, Chernovtsy Obl. Pharmacology
    (Ukraine--Pharmacy) (Pharmacy--Ukraine) Admin./Ukr.SSR Min.Heal

SHUL'MAN, A.M.

Speed up the medicinal service for workers. Farmatsev. zhur. 17 no.3:
70-71 '62. (MIRA 17:10)

1. Aptechnoye upravleniye Chernovitskogo oblastnogo otdela zdravookra-
neniya.

SHUL'MAN, A.M.

Pharmacy in Bukovina. Apt. delo 3 no.4:42-43 Jl-Ag '54.   (MLRA 7:8)
        (PHARMACY,
            *in Russia)

SHUL'MAN, A.N.; DEMENT'YEV, B.P.

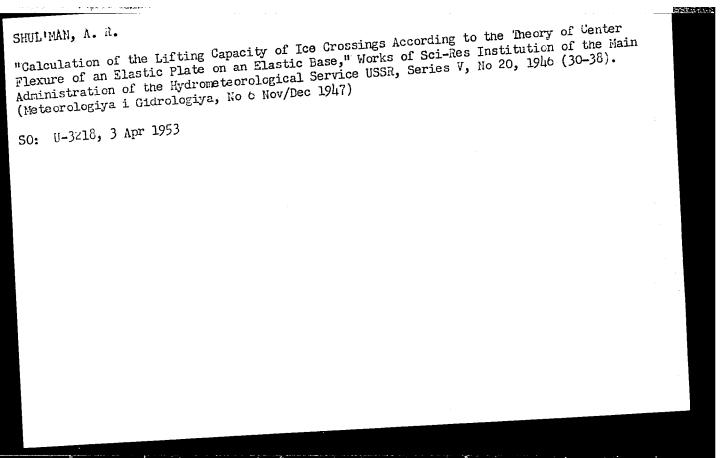Secondary electron emission of alkali halide single crystals.
Zhur.tekh.fiz. 25 no.13:2256-2263 N '55.   (MLRA 9:2)
          (Alkali metal salts) (Electrons)

SHUL'MAN, A. R.

"Problem of Calculating the Lifting Capacity of Ice Cover," Works of Sci-Res Institution of the Main Administration of the Hydrometeorological Service USSR, Series V, No 20, 1946 (9-15).
(Meteorologiya i Gidrologiya, No 6 Nov/Dec 1947)

SO: U-3218, 3 Apr 1953

SHUL'MAN, A. R.

"Calculation of the Lifting Capacity of Ice Crossings According to the Theory of Center Flexure of an Elastic Plate on an Elastic Base," Works of Sci-Res Institution of the Main Administration of the Hydrometeorological Service USSR, Series V, No 20, 1946 (30-38).
(Meteorologiya i Gidrologiya, No 6 Nov/Dec 1947)

SO: U-3218, 3 Apr 1953

SHUL'MAN, A. R.

LAGUTIN, B. L. and SHUL'MAN, A. R., "Methods for Calculating the Ice Crossings," Works of Sci-Res Institution of the Main Administration of the Hydrometeorological Service USSR, Series V, No 20, 1946 (39-49).
(Meteorologiya i Gidrologiya, No 6 Nov/Dec 1947)

SO: U-3218, 3 Apr 1953

SHUL'MAN, A. R.

"Theoretical and Experimental Basis of Tables for Load Capacity of Ice Cover," Works of
Sci-Res Institution of the Main Administration of the Hydrometeorological Service USSR,
Series V, No 20, 1946 (58-86).
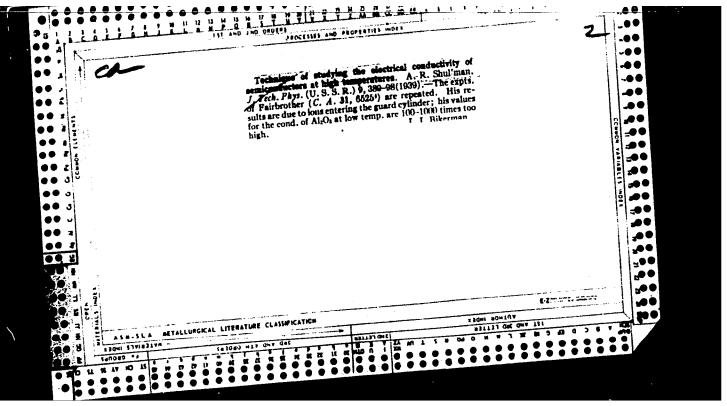(Meteorologiya i Gidrologiya, No 6 Nov/Dec 1947)
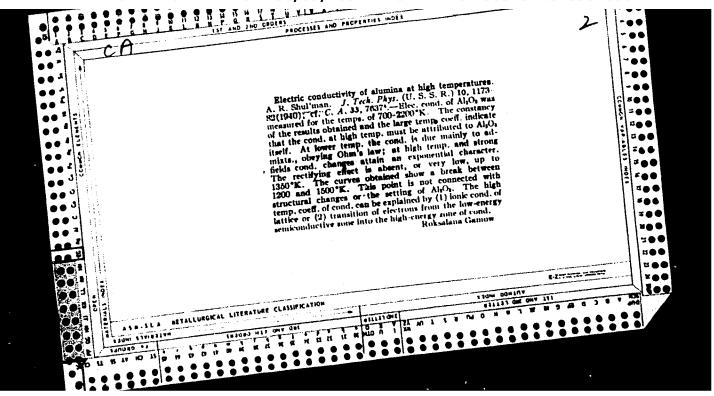
SO: U-3218, 3 Apr 1953

SHUL'MAN, A. R.

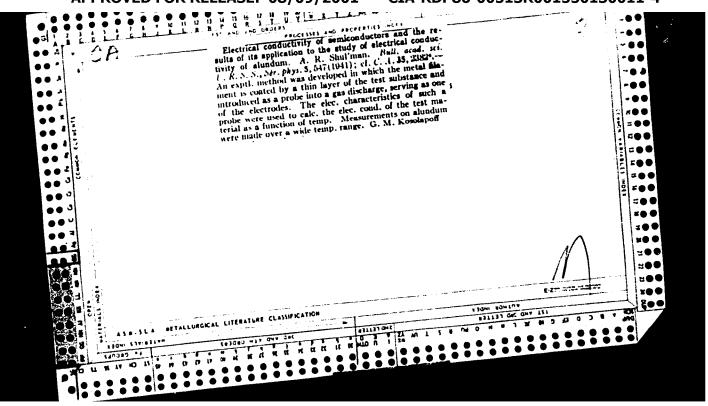28960   Nachal'nye Stadii Deformatsii L'da. Trydy Gos. Gidrol, In-Ta, Vyp. 16, 1949,
        S. 101-03

        SO: Letopis' Zhurnal'nykh Statey, Vol. 39, Moskva, 1949

Technique of studying the electrical conductivity of semiconductors at high temperatures. A. R. Shul'man. J. Tech. Phys. (U. S. S. R.) 9, 389-98(1939).—The expts. of Fairbrother (C. A. 31, 6525¹) are repeated. His results are due to ions entering the guard cylinder; his values for the cond. of Al₂O₃ at low temp. are 100-1000 times too high.   J. J. Bikerman

ASM-SLA   METALLURGICAL LITERATURE CLASSIFICATION

Electric conductivity of alumina at high temperatures. A. R. Shul'man. J. Tech. Phys. (U. S. S. R.) 10, 1173- 83(1940).—cf. C. A. 33, 7637².—Elec. cond. of Al₂O₃ was measured for the temps. of 700-2200°K. The constancy of the results obtained and the large temp. coeff. indicate that the cond. at high temp. must be attributed to Al₂O₃ itself. At lower temp. the cond. is due mainly to admixts., obeying Ohm's law; at high temp. and strong fields cond. changes attain an exponential character. The rectifying effect is absent, or very low, up to 1350°K. The curves obtained show a break between 1200 and 1500°K. This point is not connected with structural changes or the setting of Al₂O₃. The high temp. coeff. of cond. can be explained by (1) ionic cond. of lattice or (2) transition of electrons from the low-energy semiconductive zone into the high-energy zone of cond.
Roksalana Gamow

Electrical conductivity of semiconductors and the results of its application to the study of electrical conductivity of alundum. A. R. Shul'man, *Bull. acad. sci. U.R.S.S., Sér. phys.* **5**, 547(1941); cf. *C. A.* **35**, 2125. An exptl. method was developed in which the metal filament is coated by a thin layer of the test substance and introduced as a probe into a gas discharge, serving as one of the electrodes. The elec. characteristics of such a probe were used to calc. the elec. cond. of the test material as a function of temp. Measurements on alundum were made over a wide temp. range. G. M. Kosolapoff

SHUL'MAN, A.P.

SENA, L.A.;VAVILOV, S.I., akademik, redaktor; IOFFE, A.F.akademik, re-
daktor; LUKIRSKIY, P.I., akademik, redakter; FOK , V.A., aka-
demik, redaktor; FRENKEL', Ya.I., redaktor; SHUL'MAN, A.P., re-
daktor; VOLCHOK,K.M., tekhnicheskiy redaktor.

[Colisions of electrons and ions with gas atoms] Stolknoveniia
elektronov i ienov s atomami gaza. Leningrad, Gos.izd-vo
tekhniko-teoret.lit-ry 1948. 215 p. [Microfilm]   (MLRA 10:6)

1. Chlea-korrespondent AN SSSR (for Frenkel')
    (Collisions (Nuclear physics))

B 65
c

SA

621.385

3415. The nature of currents forming the basic component of valve hum.
A. S. Shulman. J. Tech. Phys., USSR, 20 (No. 12) 1505-8 (1950) In
Russian.
    After experimental investigation of 50-100 c/s hum induced in
the anode loads of indirectly a.c. heated amplifier valves it is
shown that the main hum component is produced by a current flowing
between heater filament core and the cathode. This current is due to
thermo-emission of electrons and ions from heater core to cathode
and also sometimes from cathode to heater surface, the intensity and
polarity being dependent on the amount of impurities in the Al_2O_3
filament coating.

A. Landman

METALLURGICAL LITERATURE CLASSIFICATION

SHUL'MAN, A. R.

USSR/Physics - Electron Emission,   21 Sep 50
                Secondary

"Secondary Electron Emission of Aluminum Ox-
ide," A. R. Shul'man, I. Yu. Rozentsveyg, Len-
ingrad Polytech Inst imeni Kalinin

"Dok Ak Nauk SSSR" Vol LXXIV, No 3, pp 497-500

Clarifies nature of temp dependence of coeff,
sigma, for dielec and semiconductors. Curves
of sigma vs electron energy and temp (1,400-
1,900°C); voltage drop in dielec layer vs
temp for secondary and thermoelectron emissions;
sigma vs time. Submitted 15 Jul 50 by Acad P.
I. Lukirskiy.
                            174T77

SHUL'MAN, A. R.

GTRSPL, Vol. 4, No. 8

Shul'man, A. R., The nature of currents creating the main component of noise of radio tubes, 1505-8.

Zhurnal Tekhnicheskoi Fiziki, Vol. 20, No. 12 (1951)

SHUL'MAN, A.R

6

U S S R .

Heat conductivity of aluminum oxide at high temperatures. A. R. Shul'man, V. N. Fedorov, and M. A. Shepsenvol. Zhur. Tekh. Fiz. 22, 1271-80(1952); Science Abstr, 56A, 772(1953).—A method is suggested of detg. heat cond. of ceramic materials at high temps., consisting in comparing results of measurements conducted by 2 methods: that of the shift of specific power characteristics and the probe method. In the first method, differential measurements are made on specimens in which the substance tested forms a tubular layer around a W filament through which current is passed. In the 2nd, a thin W filament is wound around the specimen and coated with a thin layer of the tested material; this thin W filament serves as resistance thermometer.   R. D. H.

SHUL'MAN, A. R.

USSR/Electronics - Dielectrics, Secondary   Oct 52
                    Emission

"Study of Secondary Electron Emission of Dielectrics
in the Range of Single Pulses" A. R. Shul'man and
V. L. Makedonskiy

"Zhur Tekh Fiz" Vol 22, No 10, pp 1540-1542

Coeff of secondary emission of dielectric varies with
time. Writers tested coeff by 3 methods: under
stationary initial current, under periodic pulses,
and under single pulses. Results on tantalum target
showed agreement with data obtained by Warneke.
Received 25 Jun 52.

                                    236T52

SHULMAN, A. R.

USSR.

Secondary electronic emission for sodium chloride, glass, and aluminum oxide at different temperatures. A. R. Shul'man, V. L. Makedonskii, and I. D. Yaroshetskii. *Zhur. Tekh. Fiz.* 23, 1152-60(1953).—The method of single impulses was used to measure the coeffs. of the secondary electronic emission σ for 3 types of Al_2O_3, monocryst. NaCl, and glass at different temps. and for different values of V_P, the energy of the primary electrons. The value of σ does not depend upon temp. The effect of a gas film on the value of σ was detd. J. Rovtar Leach

SHUL' MAN, A.R.

Threshold of the secondary electron emission of nickel and molybdenum. A. R. Shul'man and B. P. Myakinin. Doklady Akad. Nauk U.S.S.R. 1076-8(1953)(Engl. translation issued as U.S. Atomic Energy Comm. NSF-tr-177, 4 pp.(1954)).—The threshold of the energy of the primary emission is the smallest value of the energy of the primary electrons for which the no. of slow secondary electrons is distinguishable from zero. The measurements are made in a vacuum of 2×10^{-7} as measured with an ionization gage. In order to obtain reliable results the target is baked in high vacuum for 10 days. The measured value of the threshold of secondary emission somewhat exceeds the work function of the given metal. For Ni the work function is 5.05 e.v. and the emission threshold. 5.2 e.v.; the corresponding figures for Mo are 4.16 e.v. and 4.3 e.v. The existence of a threshold secondary emission close to the work function of the metal indicates that, at least for small velocities of primary electrons, the secondary electrons come from the conducting region. George Meister

Shul'man, A.R.

Thermoelectric emission of thin layers of thorium oxide and thorium on molybdenum. A. R. Shul'man and A. P. Rumyantsev. Doklady Akad. ~~~~~~~93, 455-8 (1953).—The study was carried out with a diode consisting of a Mo foil, total length 120-130 mm. and effective length 70-80 mm., 1 mm. wide and 0.025 mm. thick. Plating of thorium or thorium oxide made possible rapid detn. of the film thickness by radioactive means. The emission current A was detd. at various temps. and at varying levels of cathode activation. The emission could be detd. by measuring the change of current energy at const. temp. or by maintaining the anode fixed and changing the temp. After completion of the tests the Mo was removed from the diode and placed on a photographic plate, on which subsequently the no. of the paths of α-particles could be detd. The thickness of the Th film was varied from 0 to 90 monolayers. In the temp. range 1000 to 1500°K. the emission was identical with cathode activation. In the range 860 to 1200°K. activity of the cathode was independent of the layer thickness of thorium and amounted to 4.3 e.v. at A = 4300 amp./sq. m.-degree K.   M. O. Golovey

FD-509

SHUL'MAN, A. R.

USSR/Electronics - Secondary emission

Card 1/1   :   Pub. 153-9/28

Author   :   Shul'man, A. R., and Yaroshetskiy, I. D.

Title   :   Secondary electronic emission of thorium oxide

Periodical   :   Zhur. tekh. fiz. 24, 845-854, May 1954

Abstract   :   Investigates the dependence of the coefficient of secondary electronic
                     emission upon the energy of the primary electrons and upon the tem-
                     perature of the target. Concludes that the transition of theorium
                     oxide from the inactivated state to the activiated slate is accompanied
                     by a decrease in the coefficient of secondary emission, which fact
                     does not substantiate the conclusion of Arizumi and Esaki (J. Phys.
                     Soc. Jap. o, 115, 1951). Thanks Acad. P. I. Lukirskiy, in whose
                     laboratory the work was done.

Institution   :

Submitted   :   December 10, 1953

Shulman, A. R.

4

Inelastic scattering of electrons on single crystals of
sodium chloride and potassium chloride. A. R. Shulman
and S. A. Fridrikhov. *Zhur. Tekh. Fiz.* 25, 1344-6(1955).—
A freshly cleaved (100) crystal surface of NaCl or KCl was
bombarded by square pulses of electrons of 2 microsec. dura-
tion, at a repetition rate of 50 times per sec. The crystal
surface was held at 300°. The curve of collected electrons
is composed of several max. corresponding to elastically re-
flected electrons, slow secondary electrons, and some inter-
mediate states. The experimentally obtained max. are
compared to calcd. values.   S. Paksver

①

FD-3129

USSR/Physics - Semiconductors

Card 1/1   Pub 153 - 4/19

Author   : Shul'man, A. R.; Pisarevskiy, A. N.

Title   : Temperature variations in the work function of n-germanium and p-germa-
              nium

Periodical : Zhur. tekh. fiz., 25, No 9 (September), 1955, 1547-1555

Abstract   : The authors pose the problem of simultaneously determining the tempera-
              ture dependences of work function and position of level of chemical po-
              tential in n-germanium and p-germanium. In future works they will in-
              vestigate also the electrical conductivity and thermo-emf of specimens.
              They claim that the literature contains no description indicating the
              behavior of the variation of chemical potential with temperature on the
              basis of direct experiments. They note that A. N. Arsen'yeva-Geyl'
              (ibid., this issue; see preceding abstract) has observed certain varia-
              tion in the position of the Fermi level in germanium with temperature
              change. They describe procedure, control measurements, results, and con-
              clusions (e.g. the existence of a definite temperature dependence of
              measured work function varying for n-germanium and p-germanium). Fif-
              teen references, mostly Western. The authors thank Academician P. I.
              Lukirskiy, in whose laboratory the work was conducted, and also A. I.
              Stekhanov for preparation of the filters used.

Institution :
Submitted   : January 18, 1955

SHULMAN, A. R.

*Thermo-Emissive Properties of Thin Films of Thorium Oxide and of Thorium on Metallic Substrates. A. R. Shul'man and A. P. Rumyantsev (Zhur. Tekhn. Fiziki, 1955, 25, (11), 1898-1909).—[In Russian]. An apparatus is described for determining the thermo-emissive properties of Mo and Pt filaments activated with Th and ThO_2. Results are presented as an extensive series of graphs giving the parameters ϕ (work-function) and A of the Richardson thermo-emission equation as functions of the thickness of the activating layer, temp. of activation, and chem. nature of the substrate. Comparison with values of ϕ and A in the literature (e.g. Moor and Allison, Phys. Rev., 1950, [ii], 77, 246) show that when the active layer is thin (~0·7 mol. thick) ϕ and A have the values corresponding to the substrate. Thicker layers (~2 mol.) give thermo-emission characteristics corresponding to bulk Th, while very thick layers (5-90 mol.) have the characteristics of bulk ThO_2.—A. F. B.

FH

SHUL'MAN, A. R.

537.533.8 : 537.226   3344
    Secondary Electron Emission from Dielectrics.—
A. R. Shul'man. (Zh. tekh. Fiz., Oct. 1955, Vol. 25, No.
12, pp. 2150–2156.) Experiments are described in which,
in order to avoid changes in the structure of the target
due to electron bombardment, the primary beam was
switched on for only 10–30 μs, so that there was one
incident electron for about 10^3 atoms of the emitter
surface, and the destruction of the target could therefore
be neglected. The results obtained are different from
those usually quoted; a new interpretation of the
phenomenon is given.

FD-3140

USSR, Physics - Secondary electron emission

Card 1/2   Pub. 153 - 2/26

Author   : Shul'man, A. R.; Dement'yev, B. P.

Title   : Secondary electron emission from single-crystals of alkali-halide compounds

Periodical : Zhur. tekh. fiz., 25, No 13 (November), 1955, 2256-2263

Abstract   : In their laboratory the authors earlier investigated the secondary
emission properties of alkali-halide crystals, which turned out to be
very convenient objects for the study of the principal laws of secondary
electron emission (A. R. Shul'man, V. L. Makedonskiy, I. D. Yaroshetskiy,
ibid., 23, 1152, 1953; A. R. Shul'man, ibid., 25, 1955). In the present
article they describe further experiments in this direction. They obtain
curves of the dependence o = $f(V_p)$ for three alkali-halide single-crystals
(KI, KBr, NaCl) and show that this dependence in dielectrics possesses a
different form from that of metals. Their analysis of velocities of
secondary electrons shows that in dielectrics most of the secondary
electrons possess about identical energies in distinction to metals, in
which the scatter of velocities of secondary electrons is comparatively
large (6 to 8 times larger than in dielectrics). Variation of the curves
of energy distribution of secondary electrons for various V_p and tempera-
tures is found to be small, which evidently points to decrease in yield
of secondary electrons which in large degree is caused by absorption
of secondary electrons rather than by photon losses. The authors obtain

Card 2/2

FD-3146

quantitative data on the temperature dependence of sigma o (the coefficient of secondary electron emission) in the substances investigated, and interpret the results obtained from the view point of the reality of the linear law of deceleration for primary electrons of medium velocities. Six references: e.g. L. N. Dobretsov, A. S. Titkov, DAN SSSR, 100, 33, 1955; N. D. Morgulis, N. G. Nakhodkin, DAN SSSR, 94, 1029, 1954.

Institution :   -

Submitted   : April 13, 1955

SHUL'MAN, A.R.; FARBSHTEYN, I.I.

Inelastic scattering of electrons in nickel and molybdenum targets.
Dokl.AN SSSR 104 no.1:56-59 S '55.
(MLRA 9:2)

1.Leningradskiy politekhnicheskiy institut imeni M.I.Kalinina.
Predstavleno akademikom A.F.Ioffe.
(Electrons--Scattering) (Collisions (Nuclear physics)

SHUL'MAN, A.R.

Interpreting experimental data on thermionic emission and electric
conductivity of transistors. Trudy LPI no.181:149-156 '55.
(Transistors) (Thermionic emission)   (MLRA 10:1)

SHUL'MAN, A.R.
Determining the relationship of temperature to the output og
semiconductors and metals. Trudy LPI no.181:180-182 '55.
        (Semiconductors)   (MLRA 10:1)

SHUL'MAN, A. R. Doc Phys-Math Sci --(diss) "Study of the properties of secondary
electronic emission of dielectrics and metals." Len,1956. 22 pp 21 cm. (Min of
Higher Education USSR. Len Polytechnic Inst im M. I. Kalinin), 100 copies

(KL, 7-57, 104

Shulman, A. R.

537.533 : 621.38.032.21

1398

Material [presented] at the All-Union Conference on Cathode Electronics (Kiev, 25th-29th November 1955). — (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, Sept. 1956, Vol. 20, No. 9, pp. 975-1076. In Russian.) Digests of 10 papers and full texts of the following are presented (see also 80 of 1957):

Some Results and Problems in the Field of Cathode Electronics. — N. D. Morgulis (pp. 977-992).

Secondary-Electron Emission (Position and Prospects). — L. N. Dobretsov (pp. 994-1007).

Secondary-Electron Emission from Dielectrics and Metals. — A. R. Shulman (pp. 1008-1022).

Some Anomalies of the Secondary-Electron Emission Characteristics of Magnesium Alloys. — V. N. Lepeshinskaya (pp. 1025-1028).

Secondary-Electron Emission of Nickel-Based Alloys. — B. S. Kul'varskaya (pp. 1029-1037).

N. D. MORCEULIS

Influence of Electron Bombardment on Photoelectron Emission of Complex Photocathodes.—L. N. Bykhovskaya (pp. 1052–1064).

Influence of Adsorbed Films of Barium Atoms and Barium Oxide Polar Molecules on the Electron Work Function of Tungsten, Gold and Germanium.—V. M. Gavrilyuk (pp. 1071–1075).

Shul'man, A. R.

Secondary electron emission from dielectrics and metals. A. R. Shul'man (M. I. Kalinin Polytech. Inst., Leningrad). *Izvest. Akad. Nauk S.S.S.R., Ser. Fiz.* 20, 1008–22(1956); cf. *C.A.* 50, 3065i.—A fine structure was discovered in the values of the secondary emission coeff. σ in the region where σ increases with increasing primary electron energy U_π. In NaCl crystals sharp increases occur at 50, 90, 140, 190, and 240 v., in KBr at 60, 120, 180 v. Such curves are reproducible. This fine structure is attributed to electron transitions from levels which are deeper than the uppermost filled band. The curves $\sigma = f(U_\pi)$ can be classified in 3 different groups: (1) dielectrics showing a sharp max. of this curve (such as glass, Al_2O_3, alkali halogen compds.); (2) dielectrics showing a const. region; (3) metals showing an intermediate type of curve. It can be shown that for amorphous dielectrics and dielectrics contg. impurities (such as Al_2O_3, $MoO)\sigma = const./U_\pi$ corresponding to a quadratic law of energy losses on electron impact. Alkali halogen compds., Al_2O_3, ThO_2 follow a linear law $\sigma = const.$ Mica has an intermediate position between the two groups. In metals both the linear and the quadratic law are acting simultaneously. The energy distribution of secondary electrons was determined on Ni and on dielectric targets. For Ni with U_π up to 18 v. the position of the max. and its half-width follows the primary beam. Beyond 18 v. neither the position nor the half width change any more. In dielectrics for medium values of U_π the max. is broad. For NaCl and $U_\pi = 50$ v. the max. is at $U_\pi =$ 2.5 e.v. and has a half-width of 2.5–3.0 v. For $U_\pi = 400$–1800 v. that max. shifts to 0.4 e.v. and has a half-width of 1.8–1.4 v. Energy distribution curves of metals with not properly degassed surface resemble those of dielectrics. The conditions of electron penetration and removal are discussed and the differences between metals and dielectrics are pointed out.   S. Paksver

H-2

USSR/Electronics - Electronic and Ionic Emission

Abs Jour   :   Referat Zhur - Fizika, No 5, 1957, 12287

Author   :   Shul'man, A.R., Myakinin, Ye.I.

Inst   :   Leningrad Pedagogical Institute, Leningrad.

Title   :   Secondary Electron Emission From Nickel and Molybdenum at Low Primary-Electron Energies.

Orig Pub   :   Zh. tekhn. fiziki, 1956, 26, No 10, 2223-2233

Abstract   :   Measurements have been made of the dependence of σ on V_p along with a simultaneous analysis of the distribution of the secondary electrons by energies, using a spherical capacitor. The curves $\sigma = f(V_p)$ have a minimum in the region $V_p \approx 4$ volts for molybdenum and in the region $V_p \approx 5$ volts for nickel. At lower energies one observes only elastic reflection of the primary electrons. At large V_p, there appear slow secondary and inelastically

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109-3-4/23

SHUL'MAN A.B

. AUTHORS: Shul'man, A.R., Zakirova, I.R., Morozov, Yu.A. and
            Fridrikhov, S.A.

. TITLE: The Problem of the Method of Investigation of Secondary
            Electron Emission of Non-metallic Substances (K voprosu
            o metode issledovaniya vtorichnoy elektronnoy emissii
            nemetallicheskikh veshchestv)

PERIODICAL: Radiotekhnika i Elektronika, 1958, Vol. III, No.3,
            pp. 329 - 338 (USSR).

ABSTRACT: Description of a method of the measurement of secondary
            electron emission is given. The method is characterised by
            the following features: reduction in the time necessary for
            the experiments, increased accuracy, good stability of the
            measuring system and the target and elimination of the ternary
            electrons. The main component of the experimental equipment
            used in the measurements is a spherical, glass bulb
            fitted with apertures for a target and an electron gun. Dia-
            meter of the sphere is 145 mm. The electron gun is of the
            standard type and is provided with a focusing electrode; it
            is also furnished with a reflecting diaphragm which eliminates
            the scattered electrons from the beam of the gun. The dia-
            phragm is given a potential near to that of the cathode. The
Card1/4   gun is screened by means of a nickel cylinder. The target is

The Problem of the Method of Investigation of Secondary Electron Emission of Non-metallic Substances

in the form of a round, flat box having a diameter of 16 mm and is fitted with a helical heater. The target is fixed on to molybdenum supports and provided with a pair of leads for supplying the current to the heater. The heater can be earthed. The supporting wires of the target are taken to the input of an amplifier. The effect of ternary electrons is reduced by placing a spherical molybdenum grid, having a diameter of 125 mm, between the collector and the target. The transparency of the grid is of the order of 0.9. The grid has an aperture with a diameter of 40 mm for the leads of the target; another aperture, having a diameter of 16 mm, is provided for the primary electron beams (impinging on the target). Both the glass sphere and the grid are coated with silver by means of an evaporation process carried out in vacuum. For the analysis of secondary electron energies, a de-celerating potential U_3 is applied between the target and the grid; a potential U_g is applied between the grid and the collector, which accelerates the secondary electrons and slows down the ternary ones. The full experimental equipment (which was built around the spherical condenser) is shown in Fig.1. This consists of

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The Problem of the Method of Investigation of Secondary Electron
Emission of Non-metallic Substances

the above mentioned electron gun, the collector and the anti-
dynatron grid and contains the following units: supplies for
the electron gun, a rotary potentiometer, supplies for the
potentiometer, a synchronous motor, a registering instrument,
a delay circuit, a rectangular pulse generator, an amplifier,
a pulse lengthener, an oscillograph with a triggered time base;
an automatic switching device and a synchronous motor driving
the tape of the registering device. The functioning of the
equipment and its applicability to the measurement of the
secondary electron emission was thoroughly investigated. It
was found that the equipment could be used for single-pulse
measurements as well as for the investigation by means of
periodically repeated pulses; in particular, it was possible
to obtain good reproducibility of the secondary emission
coefficient. The effect of the anti-dynatron grid on the
secondary emission current is illustrated by the curves of
Figs. 5, 6, 7 and 8. From these, it is concluded that U_g
should be of the order of 100 V. The stability of the primary
electron current is an important factor in the equipment,
especially when the de-celerating potential U_b is varied;

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The Problem of the Method of Investigation of Secondary Electron
Emission of Non-metallic Substances

it was found that the primary current as a function of U_3
did not vary more than 1 to 2%. Some measurements on the
distribution of the secondary electron energies were carried
out. The resulting curves are shown in Fig. 12. The Curve 1
of Fig.12 was taken for Ni at $U_3 = -V_p$ (where V_p is the
accelerating potential of the primary electrons); this curve
is in good agreement with the results obtained by R. Warnecke
(Ref.11), which are represented by Curve 2.
There are 12 figures and 12 references, of which 6 are English,
5 Russian and 1 German.

SUBMITTED: February 18, 1957

AVAILABLE: Library of Congress
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SOV/109-3-8-5/19

SHUL'MAN, A. R.

AUTHORS: Kapitsa, M.L., Mel'nikov, A.I., Morozov, A.V., Popov, B.N., Sobolevskaya, R.B., Tsarev, B.M. and Shul'man, A.R.

TITLE: Thermionic Properties of Barium Tungstate (Termoelektronnyye svoystva vol'framata bariya)

PERIODICAL: Radiotekhnika i Elektronika, 1958, Vol 3, Nr 8, pp 1010 - 1016 (USSR

ABSTRACT: The work described was concerned with the investigation of the thermionic emission of barium tungstate and Ba_2CaWO_6. The investigation was undertaken since it was thought that the resulting data might be useful in explaining the operation of the pressed cathodes and other cathodes which contain barium tungstate. The investigations were carried out on directly heated cathodes which were based on tungsten and molybdenum cores. The measurements were made on special experimental diodes, fitted with protective anodes. The cathode temperature was determined by measuring the change in the resistance of the core. All the measurements were done under static conditions. The coating of Ba_3WO_6 and Ba_2CaWO_6 were effected by two methods: a) a filament of the core metal was passed through a drop of the coating substance mixed with a binder; b) cataphoretic coating was used. In the first case, coarse-grain coatings were obtained, while the second method permitted obtaining the particles having a diameter of about 1 - 5 u. The cathodes were de-gased by heating up to 1 250 °K for the duration of 1 - 2 hours without taking any current. This processing resulted also in a partial activation of the cathodes. Further activation of the

Thermionic Properties of Barium Tungstate   SOV/109-5-5-5/10

cathodes (by heating and taking the current) was then carried out. During the preliminary activation, it was found that the work function (as measured from the Richardson curves) was of the order of 2.2 eV, while after the final activation, the work function dropped to 1.2 - 0.5 eV. The characteristics of a barium-tungstate cathode after final activation are shown in Figure 2. The emission current and the work function of the same cathode for various activating temperatures are given in Table 1. On the other hand, it was found that the cathodes of Ba_2CaWO_6 had very low emission densities. These were of the order uA/cm^2, as can be seen from Table 2. By comparing the results of Table 2 with those for Ba_3WO_6 (given in Table 3), it is seen that the emission of the latter is about 100 times higher than that of the former. It was found that the curve:

for the cathode of barium tungstate consists of three regions (Figure 4). At low temperatures (below 900 ^oK), the curve has the highest slope; the work function in this region is equal to 1.3 eV. In the regions of temperatures from 900 - 1 250 ^oK, the work function has a value of about 0.6 - 0.7 eV. Finally, at temperatures above 1 250 ^oK, the current decreases as a function of temperature and the slope of the curve cannot be regarded as representing the work function.

Thermionic Properties of Barium Tungstate   SOV/129-5-6-9/18

There are 5 figures, 5 tables and 4 references, 3 of which are Soviet and 1 English.

SUBMITTED: January 29, 1958

1. Barium tungstates--Properties   2. Thermionic emission--Analysis
3. Cathodes--Performance

SHULMAN, A.R.

57-1-13/30

AUTHORS: Shul'man, A. R., Zakirova, I. R., Morozov, Yu. A., Fridrikhov, S. A.

TITLE: Secondary Electron Emission of Nickel (Vtorichnaya elektronnaya emissiya nikelya)

PERIODICAL: Zhurnal Tekhnicheskoy Fiziki, 1958, Vol. 28, Nr 1, pp. 87-96 (USSR)

ABSTRACT: The task of the present work was to close the gaps existing in literature regarding the energy spectra of secondary electrons emitted by metals, as well as to obtain data on the distribution of secondary electrons according to energies in nickel. That is to say of all those which are emitted within the whole range of secondary electron energy at various V_p (energy of primary electrons) of from 2oo to 2ooo V with nickel. Starting from the data on the distribution of secondary electrons according to energies the problem of the importance of the quantities obtained at the investigation of the basic dependence (which characterizes the secondary emission characteristics of the material - of the dependence of the coefficients of the electron emission on V_p) is dealt with. The method of spherical condenser with a spheric

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Secondary Electron Emission of Nickel

suppressor grid was used. The method of the automatic
recording of measuring results, as described in reference
2, was also used. As result of the investigation the
following can be stated: 1) Tertiary electrons emitted from
the collector exercize an essential influence on the
measuring results of secondary current in the retarding
field. The introduction of the suppressor grid offers the
possibility to essentially decrease the influence of tertiary
electrons and thereby to obtain much more reliable data than
was earlier the case. The distribution of the secondary
electrons according to the energies of from 0 to V_p was
investigated. Complete lag curves for nickel were obtained
at V_p of from 2oo to 2ooo V. 2) In the spectrum of the
secondary electrons it is not possible to draw a limiting
line between the reflected primary and the real secondary
electrons. Apparently both kinds of electrons are represented
in all parts of the spectrum. With small energies of
secondary electrons assumption that real secondary electrons
are of dominating importance is reasoned. For the analysis
of the energy spectrum of electrons (of nickel) an assumed
border between slow and quick secondary electrons, equal to

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Secondary Electron Emission of Nickel

loo eV, is chosen. 3) The basic fact resulting from the measurements is that in the spectrum of secondary electrons of metals the relative number of quick electrons can be compared with that of slow electrons. The width of the maximum corresponding to the slow real secondary electrons is a little greater than was earlier assumed. In order to mark the number of quick secondary electrons magnitudes are introduced as follows: γ - the part of quick electrons in secondary current and η - the ratio between the number of quick electrons and the quantity of the primary current. γ increases linearly with the increase of V_p and reaches up to 26% of the total number of secondary electrons at 1600. η is only little dependent on V_p and is equal to 33% of the primary current value at 1600. 4) The retardation curves in relative coordinates coincide with one-another only if V_p is greater than 1200 V. If V_p values are smaller the curves differ. 5) With all values applied for V_p an elastic reflexion of primary electrons takes place. The reflection coefficient at $V_p >$ 800 V is not greater than 3% of the total number of primary electrons. 6) When primary current is measured in the circuit of the target in the case of not complete

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Secondary Electron Emission of Nickel

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blanking of secondary electrons for the coefficient of secondary emission σ_T a value was obtained which differs from that of total retardation of secondary electrons. 7) In order to mark the emission of slow electrons the magnitudes σ_T and δ can be used (coefficient of the emission of slow electrons). As the existing theories only take into account the stimulation of secondary electrons by primary electrons and as inelastic reflection of primary electrons and the formation of slow secondary electrons with the motion of quick secondary and of inelastically reflected primary electrons are not taken into account, the comparison between theoretical and experimental data can not be carried out with sufficient exactness. There are 12 figures and 8 references, 2 of which are Slavic.

ASSOCIATION: Leningrad Polytechnical Institute   imeni M. I. Kalinin (Leningradskiy politekhnicheskiy institut imeni M. I. Kalinina)

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Secondary Electron Emission of Nickel

57-1-13/30

SUBMITTED: March 5, 1957

AVAILABLE: Library of Congress

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SHUL'MAN, A.R.

Work function of thin films of thorium oxide and thorium on
tungsten. Zhur. tekh. fiz. 28 no. 8:1711-1713 Ag '58.   (MIRA 11:10)

1. Leningradskiy politekhnicheskiy institut imeni M.I.Kalinina.
                    (Thorium oxides)
                    (Thorium)
                    (Tungsten)

BAZHANOVA, N.P. [translator]; FRIDRIKHOV, S.A. [translator]; KAPITSA, M.L.[translator]; LEPESHINSKAYA, V.N. [translator]; SHUL'MAN, A.R., red.; POPOV, R.Yu., red.; KLIMENKO, S.V., tekhn.red.

[Characteristic energy losses of electrons in solids; collection of articles] Kharakteristicheskie poteri energii elektronov v tverdykh telakh; sbornik statei. Moskva, Izd-vo inostr.lit-ry, 1959. 270 p. (MIRA 12:7)

1. Sotrudniki kafedry elektroniki Leningradskogo politekhnicheskogo instituta (for Bazhanova, Fridrikhov, Kapitsa, Lepeshinskaya).
(Electrons)

67312

q. 31.20

~~9 (3), 24 (3)~~

SOV/181-1 3-17/32

AUTHORS: Fridrikhov, S. A., Shul'man, A. R.

TITLE: Investigation of Secondary Electron Emission of Some
             Dielectrics With Low Primary Electron Energies

PERIODICAL: Fizika tverdogo tela, 1959, Vol 1 , Nr 8, pp 1259 - 1267 (USSR)

ABSTRACT: The present paper gives part of the results of the experiments
             carried out in the authors' laboratory on secondary electron
             emission of some dielectrics and semiconductors (mica, glass,
             alundum, fluorite, willemite, stibnite, etc) for low primary
             electron energies. Measurements were made by the pulse method,
             and an accuracy of 3 to 5% was attained when periodic pulses
             were used. The $\sigma = f(V_p)$ curve (V_p denoting primary electron
             energy) has a clearly marked minimum with v_p = 60 to 70 v. The
             first critical potentials of the substances investigated are
             summarized in a table. With low primary electron energies the
             $\sigma(V_p)$ function depends on elastic and inelastic reflection of
             the primary electrons and on the emission of the true secondary
             electrons. From some definite V_p values in the range of low

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Investigation of Secondary Electron Emission of Some   SOV/181-1.-8-17/32
Dielectrics With Low Primary Electron Energies

energies onwards the slowing-down curves have a slope which
corresponds to a group of slow, obviously true secondary elec-
trons. In metals elastically reflected electrons play the main
part. If the electron energies are lower than V_p, then the
electrons of the base zone cannot be excited. Therefore, these
secondary electrons seem to be inelastically reflected primary
electrons with an energy $< V_p$. The high values of the reflec-
tion coefficient R and of σ cannot be explained only by reflec-
tion of the primary electrons from the potential barrier on the
surface of the substance. Electron – phonon collisions play the
main part in slow primary electron reflection in the range of
small V_p. This also explains the high R and σ values and the
existence of electrons with energies $< V_p$ in the electron spec-
trum. The $\delta = \delta(V_p)$ curves and, thus, also the $\sigma = f(V_p)$ curves
for the various substances differ considerably from one another
in the V_p range investigated. δ is determined essentially by
the primary electrons which are inelastically scattered by

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Investigation of Secondary Electron Emission of Some   SOV/181-1 -8-17/32
Dielectrics With Low Primary Electron Energies

phonons only at very low V_p. With a certain quantity V_p which is characteristic of every substance interactions between primary electrons and the electrons of the substance begin to play the main role. Some conclusions: The first critical potentials V_p^I do not depend on temperature. The coefficient R of elastic electron reflection is relatively great (0.6 to 0.7) in the range of very small V_p (2 to 3 v) for all dielectrics investigated, which is probably caused by quasielastic scattering of primary electrons from phonons. The $R = R(V_p)$ curves differ only slightly from one another in the substances investigated. In this V_p range the σ values are relatively great and do not differ much for the various substances. With increasing V_p, however, secondary electron emission begins to differ considerably for various substances. The σ values for

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Investigation of Secondary Electron Emission of Some   SOV/181-1.-8-17/32
Dielectrics With Low Primary Electron Energies

      average V_p are not unambiguously determined by the σ values
      with small V_p. There are 9 figures, 1 table, and 9 references,
      5 of which are Soviet.

ASSOCIATION: Leningradskiy politekhnicheskiy institut im. M. I. Kalinina
               (Leningrad Polytechnic Institute imeni M. I. Kalinin)

SUBMITTED: August 5, 1958

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9 (3)

67313

AUTHORS: Fridrikhov, S. A., Shul'man, A. R.   SOV/181-1 -8-18/32

TITLE: Investigation of Secondary Electron Emission of Alkali Halide
             Single Crystals With Low Primary Electron Energies

PERIODICAL: Fizika tverdogo tela, 1959, Vol 1, Nr 8, pp 1268 - 1271 (USSR)

ABSTRACT: The author report on part of the work carried out in their
             laboratory concerning secondary electron emission of dielec-
             trics with low energies of the bombarding electrons. Measure-
             ments were carried out by pulse methods. The measuring device
             has been described already in an earlier paper. The beam of
             primary electrons came in perpendicularly to the plane (100).
             During the measurements pressure was 2.10^{-7} torr. The results
             of measurements made with various single crystals are illustrat-
             ed in a diagram by curves $\sigma = f(V_p)$. σ denotes the secondary
             electron emission, V_p the counter potential applied to the
             collector. In the case of small V_p σ actually does not in-
             crease monotonely, for the real function $\sigma(V_p)$ has several
Card 1/4   breaks. For NaCl, e.g., σ begins to increase considerably at

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Investigation of Secondary Electron Emission of Alkali   SOV/181- 1 -8-18/32
Halide Single Crystals With Low Primary Electron Energies

50, 90, 140, 190, and 230 to 240 v. This "fine structure" is easily reproducible. Each of the alkali halide salts investigated (LiF, NaF, NaCl, KCl, KBr, KJ) has a proper "fine structure" of the curves. σ increases with decreasing width of the forbidden zone ΔE_f of the crystals. With $V_p = 240$ v, σ decreases about linearly with increasing forbidden zone width. The lower the ratio $\Delta E_f / \chi$ (where χ denotes electron affinity), the greater is σ. If V_p is of an order of several hundred v, then secondary electron emission usually is low in the case of substances with small forbidden zone width; for on their way to the surface, secondary electrons may lose much of their energy when interacting with the electrons of the ground band. In the single crystals of the alkali halide compounds investigated conditions for secondary electron emission are very favorable. In the experiments described all the conditions for the occurrence of secondary electrons are important: The observed σ values are determined by the energy which must be consumed for the transfer of the lattice electron from the

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Investigation of Secondary Electron Emission of Alkali   SOV/181-1-8-18/32
Halide Single Crystals With Low Primary Electron Energies

ASSOCIATION: Leningradskiy politekhnicheskiy institut im. M. I. Kalinina
             (Leningrad Polytechnic Institute imeni M. I. Kalinin)

SUBMITTED: August 5, 1958

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SOV/109-4-4-24/24

AUTHORS: Vasil'yev, G.F., Politova, N.M., Shabel'nikova, A.E.,
              Pervova, L.Ya. and Tasnopol'skaya, A.A.

TITLE: Interdepartmental Seminar on Cathode Electronics (The 11th
              Meeting) (Mezhduvedomstvennyy seminar po katodnoy
              elektronike) (11-e zasedaniye)

PERIODICAL: Radiotekhnika i elektronika, 1959, Vol 4, Nr 4,
              pp 731 - 732 (USSR)

ABSTRACT: A meeting of the seminar took place on December 1, 1958
              at the Institut radiotekhniki i elektroniki AN SSSR
              (Institute of Radio-engineering and Electronics of the
              Ac.Sc.USSR). During the meeting 8 papers were read.
              Yu.G. Ptushinskiy read a paper entitled: "Kinetics of
              the Adsorption of Oxygen on the Surface of Tungsten".
              The second paper, by I.M. Dykman and S.M. Pekar,
              dealt with "The Admixture Photo-effect of Semiconductors
              in the Region of the Exciton Light Absorption". The
              paper by T.L. Matskevich was devoted to "The Problem of
              the Secondary Electron Emission of Fine Films of a
              Number of Organic Substances". The problem of "Surface
              Ionisation in a Strong Electric Field on a Surface with

Card1/2   a Non-homogeneous Work Function" was considered by
              E.Ya. Zandberg and N.I. Ionov. I.N. Bakulina and
              N.I. Ionov read a paper entitled "Determination of the
              Electron Attachment Energy and of the Potentials of
              Atoms by the Method of Surface Ionisation". N.L.
              Tasnopol'skiy and A.P. Alekseyevadealt with the problem
              of "Passage of Steady-state Currents Through a Dielectric
              When the Current Carriers Are Introduced Through One of the
              Contacts by Means of Electron Bombardment". The lecture
              by D.A. Ganichev and K.G. Utkin discussed the following -
              "The Possibility of the Analysis of the Total-energy
              Distribution of Electrons in a Quasi-spherical Condenser".
              The work by M.L. Kapitsa, S.A. Fridrikhov and A.R.Shul'man
              dealt with 'an investigation of the secondary electron
              emission and the characteristic energy losses of a number
              of dielectrics (glass, mica, fluorite and alkali-haloid
              monocrystals).

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S/181/60/002/03/23/028
B006/B017

24.7700

AUTHORS: Kapitsa, M. L., Fridrikhov, S. A., Shul'man, A. R.

TITLE: Characteristic Energy Losses in the Reflection of Electrons From Single Crystals of Alkali Halide Compounds

PERIODICAL: Fizika tverdogo tela, 1960, Vol. 2, No. 3, pp. 517-523

TEXT: In a previous paper (Ref. 5) the two last-mentioned authors had already investigated inelastic electron reflection from alkali halide crystals, and they had found that the energy spectrum of secondary electrons (which are emitted by alkali halide single crystals) showed fine structure (Fig. 1 shows such a spectrum recorded on NaCl with a primary electron energy of $V_p = 30$ ev). Such curves were also recorded on KCl, KBr, KI, and LiF. It was the aim of the present paper to conduct analogous investigations with higher accuracy and with small V_p in order to find the lower boundary of primary electron energy at which peaks of the characteristic losses can still be perceived in the secondary electron spectrum; furthermore, an attempt was made to separate the two possible

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Characteristic Energy Losses in the
Reflection of Electrons From Single Crystals
of Alkali Halide Compounds

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B006/B017

systems of maxima (the so-called right system of primary electrons and
the left system of secondary electrons; the position of the maxima of
the latter is independent of V_p). The measuring technique is described
in detail. The spectrum was measured automatically at a target temperature
of 300 - 350°C, a primary current density of $10^{-7} a/cm^2$, and a pressure of
$\sim 2.10^{-7}$ torr; V_p was between 0.5 and 50 ev. Fig. 3 shows the spectra of the
electrons reflected from NaCl single crystals at V_p = 30, 32, and 34 ev.
The two systems of maxima can be clearly seen. Fig. 4 shows spectra of
electrons reflected from NaCl at V_p = 5, 7, 9, 11, and 13 ev, and Fig. 5
depicts the spectrum at V_p = 21.5 ev. Important loss peaks occurred only
at $V_p > 7$ ev. The peaks correspond to energy losses of about 1 - 1.2,
1.7 - 2, 2.6 - 2.8, 3.8 - 4.3, 5 - 5.4, 6 - 6.7, 7.5 - 8.1, 9 - 9.6, and
11 ev. The probability of higher energy losses rises with increasing V_p.
The fine structure proved to be characteristic of the substance investi-
gated. In conclusion, the results are discussed. Although the right system
of maxima can be clearly attributed to the characteristic energy losses
of electrons, the nature of the left system, however, needs further

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B006/B017

Characteristic Energy Losses in the
Reflection of Electrons From Single Crystals
of Alkali Halide Compounds

investigations. A relationship could be observed between the energy
losses below 12 ev and optical data (cf. Table). Furthermore, it was
established that the least primary electron energy at which character-
istic energy losses still occurred (7 ev) was smaller than the width of
the forbidden zone. There are 5 figures, 1 table, and 14 references:
4 Soviet, 6 US, 2 Japanese, 1 British, and 1 German.

ASSOCIATION: Leningradskiy politekhnicheskiy institut (Leningrad
              Polytechnic Institute)

SUBMITTED: June 6, 1959

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SHUL'MAN, A.R.; GEL', E.P.

Depth of coloring of alkali halide crystals when bombarded by 6 to
15 kv. electrons at different angles. Fiz. tver. tela 2 no.3:524-529
Mar '60.   (MIRA 14:8)

1. Leningradskiy politekhnicheskiy institut imeni M.I.Kalinina.
    (Electron beams) (Color centers) (Alkali metal halides)

81366
S/181/60/002/03/25/028
B006/B017

$\mathcal{QY.7700}$

AUTHORS: Shul'man, A. R., Ganichev, D. A.

TITLE: Secondary Electron Emission and Elastic Reflection of
              Electrons From Germanium Single Crystals at Low Electron
              Energies

PERIODICAL: Fizika tverdogo tela, 1960, Vol. 2, No. 3, pp. 530-536

TEXT: In the introduction, investigations of the same problems by other
authors are briefly described. The present paper reports on investi-
gations of the secondary emission of oriented germanium single crystals
in the range of primary electron energy $1 \text{ ev} < V_p \leq 50 \text{ ev}$. Measuring
technique and apparatus are described in detail. Static measurements were
made with very low primary current densities ($j \leq 10^{-8} \text{a/cm}^2$) in a well
compensated geomagnetic field (residual field 0.03 oe). The energy
analysis of secondary electrons was made by the method of the spherical
condenser (diameter of the outer sphere: 130 mm). The electron beam of
1 - 100 ev was produced with an electron gun which is schematically shown

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S/181/60/002/03/25/028
B006/B017

Secondary Electron Emission and Elastic
Reflection of Electrons From Germanium Single
Crystals at Low Electron Energies

in Fig. 1. p-type germanium single crystals (resistivity: 20 ohm.cm)
were finely ground and applied to the prepared molybdenum targets. The
measurements were made with two different samples. The electron beam
focusing was controlled by four different methods discussed here. The
results of these measurements were satisfactory, and it was found that
the primary current was independent of V_p and the collector potential.
Fig. 2 shows $\sigma = \sigma(V_p)$ for a perpendicular incidence of the electron beam
on the (100) surface. This shows that with the increase of V_p from 1 to
10 v, σ increases monotonically. In the energy range 1 - 50 v the
$\sigma (V_p)$-curve shows a more irregular course and has a maximum at about 10 v,
a minimum below a 20 v, and still an irregular increase (Fig. 3). This
diagram also shows $R(V_p)$ and $\int(V_p)$ in the same range. Fig. 4 shows $R(V_p)$
and $\sigma(V_p)$ for the germanium single crystal and a germanium film
sputtered on tungsten in the range 1 - 25 v, At the same time with $\sigma(V_p)$
also the delay curves of the secondary collector current were recorded
for different V_p values. Fig. 5 shows such values for $V_p < 5$ v, Fig. 6 for
$4.5 \le V_p \le 10.5$ and Fig. 7 for $V_p = 30.5$ v. The behavior of these curves

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Secondary Electron Emission and Elastic
Reflection of Electrons From Germanium Single
Crystals at Low Electron Energies

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partly deviates from that of metals. For comparison, Fig. 8 shows the
germanium delay curves and those of tungsten. The data obtained indicate
that single crystals and sputtered films of germanium have different
properties. As a rule, single crystals have distinct characteristic
features in the curves, which are weakened in the films or not present at
all. A comparison of the delay curves of metals, dielectrics, films, and
single crystals shows that single crystals of dielectrics have the
steepest curves. It was found that the coefficient of elastic reflection R
from germanium single crystals increases in the range $1 \leqq V_p \leqq 8$ ev and
passes through a maximum at about 8 ev. In the range $8 \leqq V_p \leqq 50$ ev it
decreases, but not monotonically. The irregular course of $R(V_p)$ cannot be
explained by assuming primary electron reflection from a potential barrier.
In this case, the surface- as well as the volume properties of the crystal
must be taken into account. In single crystals, the absolute value of R
is higher than in films. There are 8 figures and 8 references: 5 Soviet
and 2 US.

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Secondary Electron Emission and Elastic
Reflection of Electrons From Germanium Single
Crystals at Low Electron Energies

81366
S/181/60/002/03/25/028
B006/B017

ASSOCIATION: Politekhnicheskiy institut im. M. I. Kalinina Leningrad
              (Polytechnic Institute imeni M. I. Kalinin, Leningrad)

SUBMITTED: June 29, 1959

Card 4/4

MEL'NIKOV, A. I.; MOROZOV, A.V.; SOBOLEVSKAYA, R.B.; SHUL'MAN, A.R.

Thermionic emission from barium tungstate. Fiz. tver. tela 2 no.4:
704-708 Ap '60.   (MIRA 13:10)
        (Barium tungstate)   (Thermionic emission)

86435

9.4166 (3201, 1003, 1137)

S/181/60/002/011/021/042
B006/B056

AUTHORS: Shul'man, A. R., Kapitsa, M. L., Nemchenok, R. L., and
                 Zelenetskaya, Ye. V.

TITLE: Photoelectric Emission of the Systems W-BaO and W-Ba

PERIODICAL: Fizika tverdogo tela, 1960, Vol. 2, No. 11, pp. 2805-2812

TEXT: The authors' aim was a comprehensive investigation of the photo-
electric properties of the W-BaO and W-Ba systems, a comparison of the
properties of these two systems, and a study of the nature of the
photoeffect of these systems. First of all, the measuring method is de-
scribed. Fig. 1 gives a schematic representation of the device working
in plane geometry. Figs. 2 and 3 show typical spectral characteristics of
W-BaO systems. On the whole it could be observed that the quantum yield
increases monotonically with the layer thickness. In the series of measure-
ments illustrated in Fig. 3, however, this was not the case, which may be
explained by the somewhat less favorable vacuum conditions. The work func-
tion of the tungsten backing (10 - 25µ) measured by the Fowler method was
found to be 4.3 - 4.4 ev, whereas the Richardson method yielded a value of
4.5 - 4.6 ev. The yield curves were evaluated according to Fowler, and the
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Photoelectric Emission of the Systems W-BaO   86435/181/60/002/011/021/042
and W-Ba   B006/B056

result (Fig. 4) is discussed. The spectral characteristics of the photo-
emission of the W-Ba system take a similar course as those of W-BaO. It
is, however, partly smoother and without any noticeable connection
between quantum yield and layer thickness. Figs. 5 and 6 show the charac-
teristics; those shown in Fig. 6 were recorded at a much lower rate of
sputtering. Fig. 7 shows the Fowler curves which take a similar course as
those of the W-BaO system. Summing up: 1) An investigation was carried
out of the change in the work function (Fig. 8 shows the work function as
a function of the sputtering time on a cold backing) and of the quantum
yield for a thickness from 0 to 3 - 10 monomolecular layers (Figs. 2-6).
2) The spectral characteristics of the photoeffect of W-Ba are largely
monotonic up to a thickness of about 10 monomolecular layers, except for a
thickness of about one layer, where the characteristic takes an anomalous
course. 3) The spectral characteristics of the system W-BaO showed no pe-
culiarities for a thickness of less than one monomolecular layer, and in
photoemission the photoelectrons of the metal with reduced work function
play the main part. 4) For BaO coatings on a W-base with a thickness of
more than one monomolecular layer, the quantum yield curves show peculiari-
ties which cannot be ascribed neither to the properties of the W-backing
nor to BaO. Thus, BaO coatings of a thickness of one or several molecules
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Photoelectric Emission of the Systems W-BaO   S/181/60/002/011/021/042
and W-Ba   B006/B056

not only cause a decrease of the work function of the metal, but also
change the emission mechanism. Yu. S. Vedula and V. M. Gavrilyuk are
mentioned. There are 8 figures and 9 references: 5 Soviet, 2 US, 1 Japanese,
and 1 German.

ASSOCIATION: Politekhnicheskiy institut im. M. I. Kalinina Kafedra
                elektroniki Leningrad. (Polytechnic Institute imeni M. I.
                Kalinin, Chair of Electronics, Leningrad)

SUBMITTED: July 1, 1960

Legend to Figs. 2, 5: The numbers of the curves denote the sputtering
time. The higher the number, the longer the duration.
Legend to Fig. 8: 1) Source – barium beryllate, $5 \cdot 10^{-8}$ mm Hg; 2) the same
source, $5 \cdot 10^{-9}$ mm Hg; 3) and 4) "Bati" source, $5 \cdot 10^{-9}$ mm Hg.

Card 3/5

64427

S/109/60/005/05/015/021
E140/E435

24,2130

AUTHORS: Shul'man, A.R., Kirsanova, T.S. and Pavlov, V.K.

TITLE: The Work Function of Thin Films of Barium Oxide on a
              Tungsten Base

ABSTRACT: The dynamic variation of barium-oxide work function at
              various temperatures of a tungsten base is determined.
              The process is more complicated than in the case of
              metal-atom films, since along with evaporation and
              migration the film state is effected through chemical
              reactions with the base material. The film thickness
              was estimated from optical measurements and deposition
              time. Measurements of work function indicated the
              following: a) The variation of work function with film
              thickness has a monotonic character. b) The curve of
              film work function against thickness at various rates
              of deposition does not vary appreciably. Although there
              are certain common features in the behaviour of barium
              and barium-oxide films on tungsten base, the barium-oxide
              films are subject to different laws from the barium films.

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69927
S/109/60/005/05/015/021
E140/E435

The Work Function of Thin Films of Barium Oxide on a Tungsten Base

For barium the work function curve has a minimum,
for barium oxide monotonic curves are obtained. The
results are closer to those obtained by V.M.Gavrilyuk
(Ref 3,5) than those of Russel and Moore (Ref 1,2).
It is concluded that the processes occurring with
heating of the films are fairly complex and it is not
possible to explain them by any single phenomenon, for
example evaporation, but at least two processes occur,
one of which leads to increase and the other to decrease
of the work function. Therefore, deactivation curves of
the barium-oxide-tungsten system cannot be directly
treated as desorption curves. Further experimental
work is necessary in which the assumed elementary
processes can be separated. There are 7 figures,
1 table and 5 references, 2 of which are Soviet,
1 English and 2 English in Russian translation.

ASSOCIATION: Leningradskiy politekhnicheskiy institut im. M.I.Kalinina
(Leningrad Polytechnical Institute imeni M.I.Kalinin)
SUBMITTED: July 6, 1959
Card 2/2

26, 2312
9,3120 (1003, 1137, 1140)

S/109/60/005/008/005/024
E140/555

AUTHORS: Kirsanova, T.S., Shul'man, A.R. and Engovatova, N.I.,

TITLE: Emissivity of Thin Barium Oxide Films on Metal Bases

PERIODICAL: Radiotekhnika i elektronika, 1960, Vol,5, No,8,
            pp,1225-1232

TEXT: In the study of thin films, the emissivity provides a
fuller evaluation of the state of the system than a knowledge of
work function. Further, emissivity is of independent interest
since, in the last analysis, it is precisely emissivity that is the
important characteristic. Nevertheless both indices give only
aggregate results and are no measure of the individual elementary
processes (evaporation, migration, chemical reaction, etc.). The
present work therefore studies the variations of emissivity of thin
barium oxide films on tungsten occurring as a result of prolonged
heating at various temperatures. The results of the study indicate
that the emissivity of these systems depends substantially on
temperature and on the heat-treatment cycle of the films. Optimum
emissivity is obtained at definite temperatures. This is taken to
indicate that variations in film state are not connected only with

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S/109/60/005/008/005/024
E140/E555

Emissivity of Thin Barium Oxide Films on Metal Bases

evaporation of active material, since variation of work function
with thickness occurs monotonically. It is necessary to suppose
the existence of at least two elementary processes. The curves
obtained suggest the usual activation characteristic of an oxide
cathode. It is therefore supposed that at temperatures of the order
of 1200-1400°K, free barium appears in the systems studied. An
inverse relationship is found between the thickness of optimal
coating and activation temperature. However, the Richardson work
function is independent of initial film thickness. It is proposed
that increase of emission is not connected with decrease of work
function but with variation of the area of the emitting centres,
directly related to coating thickness at low thicknesses. It is
supposed that the variations observed are connected with changes of
state of the film material. The data obtained also are consistent
with the concept of migration of particles over the surface during
heat-treatment. Acknowledgments are made to the graduate student
V. I. Zarudnyy for his assistance. There are 6 figures, 2 tables
and 8 references: 6 Soviet and 2 non-Soviet.

Card 2/3

ACCESSION NR: AT4016308   S/0000/62/000/000/0263/0283

AUTHOR: Shul'man, A. R.; Fridrikhov, S. A.

TITLE: Interaction of electrons with alkali halide crystals

SOURCE: Vses. soveshch. po fiz. shchelochnogaloidn. kristallov. 2d, Riga, 1961. Trudy*. Fiz. shchelochnogaloidn. kristallov (Physics of alkali halide crystals). Riga, 1962, 263-283

TOPIC TAGS: alkali halide crystal, dielectric, dielectric surface, elastic electron reflection, crystallography, radiation defect, electron irradiation, crystal physical property

ABSTRACT: For the last seven years, systematic studies of the electron bombardment of alkali halide crystals have been conducted in the Electronics laboratory of the Leningradskiy politekhnicheskiy institut (Leningrad Politechnical Institute). They covered elastic reflection of slow electrons, nonelastic electron reflection, characteristic electron energy losses, secondary electron emission, excited conductivity of NaCl-films, and the behavior of colored crystals. To reduce the charge accumulation on the dielectric surface and the changes in the target composition and structure, the bombardment was effected by an electron beam emitted in the form of a single rectangular $1-10\,\mu$ sec pulse. An EPP-09 electron
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ACCESSION NR: AT4016308

potentiometer was used for the 1 min. tape-recordings. A drawing in the article shows the assembly in detail. Most of the results of the studies were of an exploratory nature and may be partially summarized as follows: (1) dielectrics, in contrast to metals, have a relatively high coefficient of slow electron elastic reflection, reaching a maximum of 70-80% for primary electron energies of a few ev; (2) energy spectra of electrons reflected from alkali halide crystals show two different patterns; full and discrete; (3) the threshold of second electron emission is a definition which casts some light on the energy zonal structure of alkali halide crystals; (4) the coefficient of second electron emission of the crystals is high and depends mainly on the energy of primary electrons; (5) a beam of slow electrons is a very sensitive indicator of color centers in the subsurface layer; and (6) the lower the lattice energy the greater the electron absorption; hence, the lower the depth of color penetration in the crystals. The authors make extensive use of references in their discussion of the subject. Orig. art. has: 15 figures and 3 tables.

ASSOCIATION: Leningradskiy politekhicheskiy institut im. M. I. Kalinina (Leningrad Polytechnical Institute)

Card 2/3

ACCESSION NR: AT4016308

SUBMITTED: 00

SUB CODE: GP

DATE ACQ: 06Mar64

NO REF SOV: 023

ENCL: 00

OTHER: 016

Card 3/3

S/181/62/004/003/028/045
B117/B108

AUTHORS: Shul'man, A. R., and Ganichev, D. A.

TITLE: Secondary electron emission and elastic reflection of slow
                electrons from different faces of a tungsten single crystal

PERIODICAL: Fizika tverdogo tela, v. 4, no. 3, 1962, 745 - 754

TEXT: The coefficients of secondary electron emission δ, of elastic re-
flection R, and of emission of slow electrons f as functions of primary
electron energy E_p were studied on the two faces (110) and (112) of a tung-
sten single crystal with different packings of atoms. The dependence of the
coefficients on the primary electron angle of incidence was investigated.
All measurements were made with hot targets (1300-1500°K) at a vacuum of
$\sim 10^{-9}$ mm Hg. Results: The absolute values of the work function for the
face (110) is 5.3 for the face (112) is 4.9, and for polycrystalline samples
is 4.6 ev. These values agree with published data B. G. Smirnov and G. N.
Shuppe. ZhTF, 22, 973, 1952). The curves $\delta = f(E_p)$ showed a very complex
character which was chiefly caused by the change of R with increasing E_p.
Card 1/3

Secondary electron emission and...

$S/181/62/004/003/028/045$
$B117/B108$

In the range of electron energies below 4 ev, an abnormal increase in R was observed with increasing E_p, and a tendency of R to decrease with higher E_p. At $E_p = 4$ ev, the curve $R = f(E_p)$ showed a distinct maximum which cannot be the consequence of ordinary electron diffraction on the crystal lattice. At small E_p, R depends on the crystallographic direction of the crystal face. The closely packed (110) faces have a higher R value than the (112) faces. δ increases monotonically with E_p and is nearly independent of the face structure. Position and width of the maxima corresponding to slow secondary electrons depend for small E_p on the energy of the primary electrons. With E_p of the order of 15-20 ev, the energy distribution of slow secondary electrons becomes independent of E_p. An angular dependence of δ and R was observed in the same energy range (15-20 ev). Measurements in this direction are being continued on molecularly smooth surfaces since the results obtained might be a consequence of the roughness of the surfaces. The authors thank C. N. Shuppe for supplying the single crystals. There are 10 figures and 17 references: 11 Soviet and 6 non-Soviet. The

Card 2/3

Secondary electron emission...

S/181/62/004/003/028/045
B117/B108

four most recent references to English-language publications read as follows:
L. A. MacColl. Bell. Syst. Techn. J., $\underline{30}$, 888, 1951; H. A. Fauler and H. E.
Farnsworth, Phys. Rev., $\underline{111}$, 1, 1958; H. P. Myers, Proc. Roy. Soc., $\underline{A215}$,
329, 1952. O. Richardson a. J. Gimpl. Proc. Roy. Soc. $\underline{A182}$, 17, 1943.

ASSOCIATION: Leningradskiy politekhnicheskiy institut im. M. I. Kalinina
                (Leningrad Polytechnic Institute imeni M. I. Kalinin)

PRESENTED: August 5, 1961 (initially)

SUBMITTED: November 22, 1961 (after revision)

Card 3/3

40899
S/181/62/004/009/039/045
B104/B186

24.7000,

AUTHORS: Kirsanova, T. S., Shul'man, A. R., and Dement'yeva, A. V.

TITLE: Work function of thin barium oxide films applied to heated
                tungsten

PERIODICAL: Fizika tverdogo tela, v. 4, no. 9, 1962, 2615-2617

TEXT: The change in the work function of a·BaO-W system was determined
as a function of the temperature of the W band during the spray coating
of BaO.   At pressures of the residual gas of $(1-2)\cdot10^{-9}$ mm Hg, BaO was
sprayed onto bands of temperatures between 800 and 1500°K.   The dependence
of the work function φ on the coating time t was determined for various
temperatures of the W bands (Fig.).   After some hours of spraying,
φ becomes virtually independent of the coating time (equilibrium).   If
such a film is annealed for some hours at the temperature of the W-band
during the coating, a quasistationary state is obtained in which the work
function of the system does not noticeably change even on further heating. ·
Annealing of the W-band during the spraying yields much more active
thermionic emitters and more solid films than spraying onto cold bands.
There is 1 figure.
Card 1/2

40900

S/181/62/004/009/040/045
B104/B186

24.7400
96 1640

AUTHORS: Kirsanova, T. S., Shul'man, A. R., and Gerasimova, A. P.

TITLE: Adsorption of barium oxide on the (110) face of a tungsten
               single crystal

PERIODICAL: Fizika tverdogo tela, v. 4, no. 9, 1962, 2617-2620

TEXT: The experiments were made with a method developed earlier
(T. S. Kirsanova, I. Ye. Sakharov, Radiotekhn. i elektron., 5, 69, 1960).
The (110) face of a tungsten single crystal was prepared at the
Laboratoriya kafedry elektrofiziki Tashkentskogo gosudarstvennogo
universiteta (Laboratory of the Department of Electrophysics of Tashkent
State University). The experimental arrangement permitted heat treatment
of the single crystal at temperatures up to 2600°K and simultaneous .
bombardment with electrons. The barium oxide was applied at a constant
spraying rate of 0.015 monolayers/minute. The dependence of the work
function on the temperature of the single crystal during the spraying was ·
determined (Fig.). Results: When BaO is sprayed onto hot W backings,
the adsorptive and thermionic properties of the BaO-W system depend

Card 1/*p.2*

Adsorption of barium oxide on...

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B104/B186

considerably on the crystallographic orientation of the faces. Unlike
in the adsorption of BaO on polycrystalline backings or on not densely
packed tungsten atoms (T. S. Kirsanova et al., FTT, v. 4, no. 9, 1962,
p. 2617; Radiotekhnika i elektron., 5, 840, 1960) the work function in the
interval between room temperature and $1150^\circ K$ does not decrease when BaO
is adsorbed on densely packed W atoms. This is explained by the single-
phase adsorption of barium oxide on the densely-packed tungsten surface
atoms. There is 1 figure.

ASSOCIATION: Leningradskiy politekhnicheskiy institut im. M. I. Kalinina
(Leningrad Polytechnic Institute imeni M. I. Kalinin)

SUBMITTED: May 24, 1962

Fig. Work function versus coating time t (minutes) at various temperatures
of the W single crystal.
Legend: (1) $500^\circ K$; (2) $650^\circ K$; (3) $750^\circ K$; (4) $870^\circ K$; (5) $900^\circ K$; (6) $1150^\circ K$
(annealing temperatures). Backing temperatures: (7) $300^\circ K$; (8) $650^\circ K$;
(9) $750^\circ K$; (10) $870^\circ K$; (11) $900^\circ K$; (12) $1000^\circ K$; (13) $1150^\circ K$.

Card 2/2

NEMCHENOK, R.L.; SHUL'MAN, A.R.

     Photcelectric and optical properties of a gold-barium system.
     Radiotekh. i elektron. 7 no.9:1619-1625 S '62.   (MIRA 15:9)
        (Gold)   (Barium)   (Cathodes)

S/181/63/005/003/020/046
B102/B180

AUTHORS: Shul'man, A. R., Morozov, Yu. A., and Petrov, I. N.

TITLE: Secondary electron emission from tungsten, tantalum and
             yttrium oxide in the presence of a thermoemission current

PERIODICAL: Fizika tverdogo tela, v. 5, no. 3, 1963, 839-842

TEXT: To find the reason for the great differences observed in the
temperature dependences of the secondary electron emission (coefficient
σ), the authors determined the dependence of σ on the primary electron
energy (V_p) the target temperature (T) and the pulse durations (t) of
the primary current pulses, using the method described in ZhTF, 22, 1342,
1952. t was varied from 2 to 200 μsec, V_p from 100 to 2200 ev and all
measurements were made in vacuo ($5 \cdot 10^{-9}$ mm Hg). The targets were
annealed at 2200°C (W) 1800-1850 (Ta) and 1500-1550°C (YO). It was
found that, despite the presence of thermoemission currents of up to the
10^4 times greater than the electron-emission current, σ was temperature-
Card 1/2

Secondary electron emission from ...

S/181/63/005/003/020/046
B102/B180

independent for W up to 2200°K, and up to 2100°K for Ta. For yttrium oxide σ fell slightly with temperature rising from 300 to 1500°K. The shape of the secondary current pulses remained constant for all samples, independent of t. By comparison with the results obtained for barium oxide, it is concluded that neither the presence of a thermoemission current nor a high temperature are sufficient or even necessary conditions for distortion of the secondary current pulse or for increase in σ with T. The anomalies observed at oxide cathodes must therefore be related to specific properties of the emitters. There are 3 figures.

ASSOCIATION: Leningradskiy politekhnicheskiy institut im. M. I. Kalinina (Leningrad Polytechnic Institute imeni M. I. Kalinin)

SUBMITTED: May 11, 1962 (initially)
            October 8, 1962 (after revision)

Card 2/2